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<table>
<thead>
<tr>
<th></th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teratogenic Agents and Related Conditions</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Diana Karagiozova</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>An Overview of Ebola Viral Disease</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Muekara Friday Dugbor</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Multi-Morbidity and Lifestyle in Western Nigeria: A Qualitative Study</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Sogunle PT</td>
<td></td>
</tr>
</tbody>
</table>
Teratogenic Agents and Related Conditions

Article by Diana Karagiozova
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Abstract
The term “Teratogens” was first described in Paris, France in early 1932. “Teratogens” comes from the Greek word τέρας teras, which means “monster” or “marvel”. For centuries, the meaning of the term ‘teratogens’ changed and nowadays it refers to many factors, agents or substances that can compromise the normal development of the fetus.

Many factors/agents such as physical, chemical and environmental were found to be harmful when exposure to them occurs during the pregnancy. Exposure to high doses of ionizing radiation, usage of medications, viral and bacterial diseases during the pregnancy can only result in fetus death, congenital malformations and miscarriages.

Introduction
Teratology is a study of the etiology of abnormal development or study of birth defects. Teratogens therefore are agents or substances that cause malformations in the developing fetus. Teratogens may include: substances of abuse, hormones found in contraceptive agents, cigarette components, heavy metals, ionizing radiation as well as agents with viral or bacterial etiology.

History
The word “Teratogens” originates from the Greek word τέρας teras (genitive τέρατος teratos), meaning 'monster' or 'marvel' and was given by a physician from Paris, France in 1932 in order to explain an abnormal human and animal development. For centuries, people developed different theories about the causes for the human abnormalities. In Babylon, people believed, that infants with congenital malformations were constellations in human forms. Aristotle, who lived in Athens, Greece in the fourth century, B.C., believed that birth defects are disturbances in the reproduction, while Hippocrates claimed that a pregnant woman's experiences or emotions, which were called later maternal impressions, can affect the normal development of the fetus (Greece in the fifth century B.C.). This theory of maternal impressions persisted until the early 1900, despite any evidences for the occurrences.

At the beginning of the 19th century, Johann Fredrich Meckhel, an anatomist from Halle, Germany, claimed that deviations from the normal developmental process caused malformations and are most likely caused by agents, called teratogens.

Following Meckel, scientists in the nineteenth century began experimental studies to detect the effect of different teratogens on chicken eggs. Since then, there are many reports of successfully produced abnormalities in chick embryos caused by teratogenic agents.

Nowadays, the meaning of teratogen has been given to a drug or other substance capable of interfering with the development of an embryo fetus that may lead to birth defects or developmental malformations.

The term “teratogens” was popularized in the 1960s by David Smith1, whose name was associated with the discovery of FOAS (fetal Alcohol Syndrom).

Types of teratogenic agents
For the last decades, scientists have tried to classify teratogens based on their nature and etiology. Today, teratogens can be classified in three different categories:
Physical teratogens
Infectious diseases as teratogens
Chemical teratogens
Environment teratogens is another group of agents that according to some authors can include both physical teratogens as well as infectious agents.

Physical teratogens

Physical teratogens can be ionizing or nonionizing radiation, hypothermia and mechanical forces. Some scientists classify the hypothermia into the maternal conditions group but it can be included as a physical factor as well.

Pregnant women are at risk if exposure to ionizing and non-ionizing radiation occurs. In utero, the exposure to non-ionizing radiation is not associated with significant risk for development of fetus, while the exposure to ionizing radiation can be extremely teratogenic.

X-rays Ionization or ionizing radiation

Ionizing radiation is the energy that moves atoms in a molecule and is able to remove tightly bounded electrons from atoms, creating ions. Usually ionizing radiation are X-rays and gamma rays. X-rays are part of the electromagnetic spectrum and are used to image the inside of objects (medical radiography). This is a type of ionizing radiation that can be harmful to living tissues at highly dosage.

Ionizing radiation is classified as a teratogenic agent because the exposure at high enough levels can cause development risk of the fetus and lead to severe malformations such as mental retardation, impaired brain development, cancer in later life. The eventual adverse effects in fetus depend on the dosage, time of exposure and the gestation age of the fetus. An embryo is most susceptible to the ionizing radiation during the organogenesis especially at first and second trimester of development. High levels of ionizing radiation can injure embryonic cells, resulting in death, retardation of mental development or chromosomal injury.

Nonionizing radiation

Non-ionizing radiation is low energy radiation that is not able to ionize atoms or molecules. It includes sources like power lines, infrared radiation, microwaves and ultrasonography and magnetic resonance imaging. Usually non-ionizing radiation interacts with the tissues through the generation of heat and no substantial risk has been identified 2, 3.

Today, there are no conclusive data that the non-ionizing radiation can be harmful for the developing fetus. Therefore, the ultrasonography is safe to be performed during pregnancy only when it is medically indicated and the lowest possible settings are used.

Mechanical forces

Some of the prescribed medications, taken during the pregnancy, can trigger forceful uterine contractions that can eventually lead to injuring the fetus. Other can compromise the function of the placenta and thus reducing the supply of oxygen and nutrients from mother to the fetus. The movements of the fetus can be restricted by malformations of the uterus and thus to be a reason for congenital dislocations.

Infectious diseases

Many infectious diseases like Varicella Zoster Virus (VZV), Cytomegalovirus (CMV), mumps, toxoplasmosis, rubella during the pregnancy can lead to congenital malformations in fetus. Primary or recurrent CMV infection during the pregnancy can lead to intrauterine growth restrictions, microcephaly, hydrocephaly and delayed psychomotor development. Most common complications of pregnancy when exposure to Herpes virus occur is intrauterine growth restriction, preterm labor and miscarriage4, 5.

One of the most teratogenic viruses is rubella virus. Congenital rubella syndrome (CRS) is characterized by microcephaly, intracranial calcification and neurologic diseases.
Chemical factors/agent

Variety of medications and drugs in abuse are considered to be chemical teratogens. Chemical agents with teratogenic effect can be heavy metals, herbicides and industrial solvents.

Drugs

Majority of pregnant women are exposed to medications during pregnancy. Most of the drugs, taken by a pregnant woman, can cross placenta and thus act directly on the fetus causing damage, abnormal development or death.

According to FDA, there are five categories that can cause birth defects if used during pregnancy (Figure.1). Examples for medications, belonging to each group is given in table 1.

![Figure 1. FDA categories of drugs](source)

Figure, borrowed from www.medscape.com

| Table 1. Medications, referred to each drug category |
|---------------------------------|-----------------------------|
| Category | Medication | Effect |
| A | Folic acid | Important for the proper development of neural tube of the fetus |
| B | cyclobenzaprine, amoxicillin | Cyclobenzaprine is muscle relaxant used for skeletal muscle spasm and fibromyalgia syndrome; Both are safe to use during pregnancy |
| C | trazodone, prednisone | Trazodone is antidepressant and there is no data showing that taken during pregnancy causes birth defects. Prednisone is corticosteroid and data shows increased incidence of cleft palate |
Anticonvulsant agent can cause congenital malformations. Lorazepam belongs to benzodiazepines which are known with its neurotropic properties. Lorazepam affect the neural crest cells during organogenesis.

Warfarin, is anticoagulant and taken during pregnancy can cause cerebral hemorrhage, hypoplasia of baby's nose and epiphyses. Methotrexate is folic acid antagonist. Taken during pregnancy it can lead to growth retardation, skull defects, cleft palate.

<table>
<thead>
<tr>
<th>D</th>
<th>clonezapam, lorazepam</th>
<th>Anticonvulsant agent can cause congenital malformations. Lorazepam belongs to benzodiazepines which are known with its neurotropic properties. Lorazepam affect the neural crest cells during organogenesis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>warfarin, methotrexate</td>
<td>Warfarin, is anticoagulant and taken during pregnancy can cause cerebral hemorrhage, hypoplasia of baby's nose and epiphyses. Methotrexate is folic acid antagonist. Taken during pregnancy it can lead to growth retardation, skull defects, cleft palate.</td>
</tr>
</tbody>
</table>

**Dugs in abuse**

**Alcohol**

It is well known that an exposure of pregnant woman to some drugs can interfere with normal development of the fetus. It depends not only on the susceptibility of the mother and the fetus, but also the chemical and pharmacological nature of the agent, its dose, the time of gestation age at which the exposure occurs and the time of exposure. Drugs in abuse can be alcohol, tobacco, marijuana, cocaine, methadone, etc.

Alcohol is a CNS depressant and consumption of it during pregnancy can lead to congenital anomalies called fetal alcohol syndrome (FAS). Characteristic features of fetal alcohol syndrome fetal alcohol syndrome occurs in 30-40% of women who drinking heavily during pregnancy. The alcohol freely cross placenta and thus impact negatively the nervous system of the fetus. This can result in functional, neurological and structural abnormalities in the developing fetus.

**Tobacco**

Many studies show, that smoking during pregnancy can increase from up to 80% the risk of congenital malformations of the fetus. Usually, low birth weight is associated with smoking during pregnancy.

Marijuana, cocaine, amphetamines

All three groups are well known drugs of abuse. The possible adverse effect of them on the developing fetus can be associated with cardiovascular malformations, behaviors disturbances, low weight and growth retardation.

**Lead, mercury**

Lead and mercury exposure in pregnancy can result in neurological delays, miscarriages and encephalopathy. Sometimes consumption of freshwater fish, containing enough mercury can harm the development of the nervous system of the embryo or fetus.

**Air pollution**

Many compounds such as nitrogen dioxide and carbon monoxide can negatively affect pregnancy and cause growth restrictions, low birth weight and heart and lung problems.

Figure 2 shows some of the environmental teratogens and their adverse effect.
Figure 2. Teratogenic agents and their adverse effects.

Table, borrowed from http://tr-i-life.tumblr.com/post/31097290784/pharm-for-ob-teratogenic-effect

Maternal medical condition

Increase incidence of developing heart diseases, central nervous system defects and congenital malformations usually is observed on babies of mothers with diabetes mellitus. A strict glycemic control in first trimester of pregnancy is critical.

Table 2 shows all teratogenic factors that influence the development of the fetus and its adverse effects

<table>
<thead>
<tr>
<th>Agent</th>
<th>Example</th>
<th>Structural anomaly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>Microcephaly, heart defect</td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td>Vascular disruption</td>
<td></td>
</tr>
<tr>
<td>Valproate</td>
<td>mandibular/ear abnormalities</td>
<td></td>
</tr>
<tr>
<td>Vitamin A</td>
<td>Spina bifida</td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubella</td>
<td>Microcephaly, heart defect</td>
<td></td>
</tr>
<tr>
<td>Toxoplasma</td>
<td>Hydrocephalus</td>
<td></td>
</tr>
<tr>
<td>Varicella</td>
<td>Limb defects</td>
<td></td>
</tr>
<tr>
<td>Maternal factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>Heart defects, neural tube defects</td>
<td></td>
</tr>
<tr>
<td>Phenylketonuria</td>
<td>Microcephaly, heart defect</td>
<td></td>
</tr>
</tbody>
</table>
Factors influencing the effect of teratogens

The pathogenic effect of teratogens is associated with the nature of the agents, their mechanism of action, gestation age at which the exposure occurs as well as the dosage and duration of that exposure.

Nature of teratogenic agent and the ability to cross placenta

Not all teratogens can pass directly through the tissue (radiation and ultrasound). Most of the teratogenic agents access the embryo through fluids (blood) after formation of the placenta. Now it is known that the “placenta barrier” does not protect the fetus from readily passing pharmacologic substances through it. Teratogenicity of agents depends on their ability to cross placenta. The nature of teratogens is strongly related to that ability. Teratogens with high molecular weight of 500Da (and less) and low ionic charge can pass placenta by simple diffusion. Some chemical compound with greater molecular weight (above 600Da) cannot pass through placenta readily, therefore heparin (with molecular weight of 20 000Da) as a coagulant can be given instead of warfarin-like compounds during pregnancy10. Placenta transfer depends strongly not only on the chemical structure of teratogens, but also on the placenta proteins, related to the binding with the agents, crossing placenta. Since the placenta is buildup of membranes with lipid structure, the transfer of lipid-soluble agents is more facilitated. Or in other word, the more lipid soluble, the easier the drug crosses placenta. Also, the transport depends on the size of the compound and its charge. The less charged and the smaller the molecule is, the more easily it crosses placenta9. For example, retinoids are considered to be teratogens and should not be taken during the pregnancy due to their ability to easily cross placenta. Taking Vitamin A supplements above RDA of 2,700 IU can result in hydrocephalus, heart defects and defects in cardiovascular system.

Mechanism of action

There are several mechanism of action of teratogens described. Folic acid inhibitors, drugs that can change the metabolism of hormones, redox-cycling agents and neural crest inhibitors are four types of teratogens that have different mechanism of action. They have their unique way to inhibit/change the metabolism of the fetus and thus to lead to variety of congenital malformations.

Folic acid antagonists

Folic acid is essential for normal development of neural tube of the fetus. Some drugs, taken during pregnancy, can inhibit the synthesis of folic acid. Many anti-folic agents targeting fast-dividing cells and thus result in adverse effects on the skin, hair, bone marrow. Trimethoprim, for example, is prescribed for treatment of urinary infections and there is data showing that taken during first trimester can lead to increased risk of neural tube defects as well as oral clefts, urinary-tract defects and cardiovascular defects.

Antibiotics as folic acid inhibitors, such as tetracycline’s, can easily cross placenta and inhibit the bone growth of the fetus. The usage of aminoglycosides during first trimester of pregnancy can lead to congenital deafness.

Hormones as disruptors of endocrine system

The metabolism of endogenous hormones may be disrupted by many synthetic estrogens, given during pregnancy. One of the mechanisms of synthetic estrogens is disruption of the signaling pathway of androgen that can lead to reproductive disorders in offspring. Androgenic hormones such as synthetic progesterone, which were used in treatment of breast cancer, can lead to spontaneous abortions. Using them to control the bleeding during pregnancy can result in masculinization of female fetuses11. Hormone disruptors may either block the binding of a hormone to its receptor or block their synthesis.
Oxidative stress

Many drugs that are widely used for treatment of cardiac diseases and epilepsy are known as redox cycling agents. Their mechanism of action involves formation of various radicals such as superoxide that can lead to oxidative stress and thus inactivate many enzymes and cell death. Current antiepileptic drug targets are voltage-gated sodium and potassium channels, responsible for depolarization of the nerve cell membrane. Blocking the membranes, they lead to generation of radicals that are harmful for the organogenesis.

Exposure to sodium valproate as an antiepileptic drug has high risk of major congenital malformations, while treatment with carbamazepine has lower risk of birth defects.

Neural crest disruptors

This group includes drugs that cause interference in migration, proliferation and differentiation of neural crest cells. Some of teratogenic drugs within this group are bosentan, isotretinoin and ketoconazole. Since the neural crest is important pluriotent cell population for cranial and cardiovascular region, the treatment with neural crest inhibitors during pregnancy leads to cardiovascular and craniofacial malformations.

Timing of exposure

An important factor for the normal development of the fetus is the time (gestational age) when the exposure to teratogens occurs. All embryo organs passes through different periods of development during each it can be or cannot be susceptible to teratogens.

Each organ has its critical period of development which corresponds to the time when the organ develops most rapidly. During this critical period, exposure to teratogens can cause morphological changes to the fetus. Figure 3 shows the stages of development of the fetus and its sensitivity to teratogens.

Figure 3. Stages of fetus development and sensitivity to teratogens

Figure15, borrowed from https://sara1hays.wordpress.com/2008/02/12/antepartal-care-teratology/
As shown in Figure 1, each organ has limited period of susceptibility to teratogens. There are periods to where the particular organ has less or higher sensitivity to the agents. Usually the first eight weeks of early development are essential and the development of the fetus can be compromised by teratogens. Drugs, prescribed for nausea and vomiting in pregnancy like Antihistamines (H1 blockers) have been used for treatment of morning sickness. Some of them have been associated with fetal malformations when they were used in first weeks of pregnancy. Thalidomide (for leprosy and cancer treatment) was widely used as an anti-nausea agent and in 1960s and one of the birth defects observed was shortened limbs.

Usually, first trimester exposure to variety of teratogens is a risk factor for major congenital malformations. For example, many epileptic drugs, taken during first trimester of cause congenital malformations like cleft palate, cardiovascular defect and growth retardation.

Exposure to teratogens during second and third trimester also has risk to the fetus and unlikely result in physical birth defects. The critical period for brain growth is from 3 to 16 week, so exposure to teratogens during the period can result in mental retardations during both embryonic and fetal period. The stage of exposure is a critical parameter for the normal development of the embryo/fetus (table 3).

Table 3. Stage of exposure and related outcome.

<table>
<thead>
<tr>
<th>Stage of exposure</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-implantation</td>
<td>Embryonic lethality</td>
</tr>
<tr>
<td>Implantation to time of organogenesis</td>
<td>Morphological defects</td>
</tr>
<tr>
<td>Fetal-neonatal stage</td>
<td>Functional disorders, growth retardation</td>
</tr>
</tbody>
</table>

Variety of analgesics (aspirin), anticonvulsants, anticoagulants, Vitamin A, aminoglycoside can affect the fetus if taken in first trimester of pregnancy. The possible adverse effects are shown in table 4.

Table 4. Adverse effect of some of teratogens during first, second and third trimester of pregnancy.

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Teratogen</th>
<th>Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>First trimester</td>
<td>analgetics (aspirin)</td>
<td>Gastrochisis; during pregnancy can lead to bleeding because aspirin decrease platelet aggregation</td>
</tr>
<tr>
<td></td>
<td>anticonvulsants</td>
<td>Fetal hydantoin syndrome; congenital heart disease, short limb formation</td>
</tr>
<tr>
<td></td>
<td>anticoagulant (Wafarin)</td>
<td>Fetal wafarin syndrome; respiratorry distress syndrome</td>
</tr>
<tr>
<td></td>
<td>Antidepresant</td>
<td>cleft palate; cardiovascular defect</td>
</tr>
<tr>
<td></td>
<td>Vitamin A</td>
<td>Cranio-facial dysmorphism</td>
</tr>
<tr>
<td></td>
<td>aminoglycosides</td>
<td>Ototoxicity, congenital deafness</td>
</tr>
<tr>
<td>Second trimester</td>
<td>ACE inhibitors (Diazepam)</td>
<td>death, fetal hypotension, cleft palate</td>
</tr>
<tr>
<td>Third trimester</td>
<td>Antibiotics (Tetraciclines)</td>
<td>maternal hepatotoxicity; dental discoloration in children</td>
</tr>
<tr>
<td>ACE inhibitors (Diazepam)</td>
<td>death, fetal hypotension, cleft palate</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td>vestibular nerve damage</td>
<td></td>
</tr>
<tr>
<td>Sylfamethoxazole trimethoprim</td>
<td>neonatal haemolysis</td>
<td></td>
</tr>
</tbody>
</table>

**Pattern of exposure**

The duration of the stimulus and the dose of exposure to teratogens are related to the type of abnormalities. Usually the dose of the teratogenic agent is critical and it influences the degree of harm of the fetus. In order to control the level of exposure to teratogens, the dose-response function is important to be known for each particular component. The range of doses can be divided into three categories - subthreshold, teratogenic and lethal category.

In general, there is a range of doses below which no effect occurs (low teratogenicity, no effect on the fetus). The exposure dose in this case is referred to as threshold dose (Figure 4). Usually an increase of intensity or duration of treatment reflects to an increase in frequency and severity of the defect.

**Dose-response function with a no-effect region**

![Dose-response function](http://www.mackinac.org/media/images/2010/MS2010-01-graph1LRG.jpg)

**Figure 4.** Dose-response effect of teratogens

Table was borrowed from http://www.mackinac.org/media/images/2010/MS2010-01-graph1LRG.jpg

The teratogenicity depends on the route of administration of the agent as well. An example of dose-response relationship is Accutane taken by mouth and Retin A, applied topically for treatment of acne of pregnant women. Accutane causes major malformations and high rate of mental retardations while the Retin-A has no effect on the development of the fetus. Another example is the dose-relationship between Valproic acid given in different dosages. When the dose, to which the fetus was exposed, is around 75mg/l, the most common adverse effect is spine bifida. In contrast, exposed fetuses to dose of 44mg/l there are no any birth defects observed17.
Genetic factors

The susceptibility to environmental agents varies extremely from one individual to another, even after an identical exposure to teratogens occurs. Both maternal and fetus genotypes can affect the teratogenicity of variety environmental agents.

There is evidence, that compromised embryo glucose control for example predispose embryo to developmental anomalies. Other metabolite syndromes and diseases such as diabetes create a compromise environment for the developing embryo.

The genetic factor is very important for the susceptibility to certain teratogens and the outcome of the teratogenicity.

There are evidences that the intrauterine exposure to valproate show that not all fetuses were born with birth defects. This confirms the fact that there is multifactorial factor in which other components were involved, mostly likely genetic predisposition19.

Risk factors

Teratogens any agents from the environment, that can cause variety of birth defects and congenital malformations of the developing fetus. They can cause damage only if the exposure occurs during sensitive periods of the development.

There are some risk factors that are essential and the normal development of the fetus depends strictly on them:

- Maternal health status (existing maternal conditions such as hypertension, diabetus mellitus).
- Nutrition - pregnant women should be advised to take vitamin supplements, eat folacin rich food and should take 400ug folic acid daily.
- Stress - prolonged stress can put a fetus at risk for lower birth weight and children with emotional problems and behavior disorders.
- Working environment - pregnant women should avoid working in environment with hazardous compounds

Prevention

Variety of birth defects and congenital malformations are caused by many environment factors. Prevention is important part for the normal development of fetus.

One of the prevention factors is the modification of the prenatal environment. This can be achieved when pregnant women consume 400mg of folic acid daily so normal development of neural tube can occur. The intake of folic acid supplements show prevention of 50% to 70% of neural tube defects in fetus.

Limiting exposure to teratogens such as smoking, alcohol consumption, medications, hazardous materials and industrial chemicals.

Reducing sugar intake. The right nutrient balance is an important factor in the development of a healthy child. The control of gestational diabetes by limiting sugar intake and exercising is extremely important for the normal outcome.


The awareness of the effects of various teratogen factors could reduce the probability of some birth defects.

Risk assessment

It is important to fully understand and evaluate the potential risk to pregnant women’s health from exposure to variety of teratogen agents including chemicals, drugs, medications, environmental factors. The exposure too many chemicals, hazardous materials, pharmaceutical drugs can compromise the normal development of the embryo.
In order to assess the risk of all environmental factors that can influence the development of the fetus, four steps were followed:

1. Identification of drugs, medications, hazardous material - important to determine whether the medication that was prescribed or the chemical component that the mother was exposed to during the pregnancy is related to particular health effects.
2. Dose-response - it is very important to determine the relationship between the dose of the environmental factor and the probability of occurrence of health effects.
3. Type of exposure - it includes the source of exposure and the pathways of exposure.
4. Teratogen risk counseling - counseling to possible teratogenic risks should be provided by physician or other health care professionals. When estimating the potential teratogenic risk, the maternal health and the gestational age should be taken as a consideration.
5. Risk characterization - to describe the possibility of the risk, including all sources of uncertainty.

**Work-related aspects**

Approximately 10% of all birth defects are caused by environmental contaminants such as chemicals, industrial products, and air pollution. According to statistic, there are about 4 million chemicals presented in home and work environments. Many hazardous compounds are found to be teratogenic and are harmful for pregnant women. The control on the working environment is strictly regulated by three instances. The Occupational Safety and Health Administration (OSHA) is a federal agency responsible for setting standards for working with hazardous materials. Protection Agency (PA) is responsible for controlling the maximum levels of hazardous substances in the air and water. Finally, Food and Drug Administration (9FDA) regulates the presence of hazardous compounds in food, drugs, cosmetic products. While all of these agencies work to protect the health of the public, it is still possible for a pregnant woman to be exposed to these harmful chemicals. Knowing which to avoid during pregnancy is crucial to protecting the health of the mother and her child.

Hazardous compounds such as toluene, xylene, organic solvents, methyl ethyl ketone, chlorine, ethers are all teratogens that can compromise the development of the fetus. Pregnant women, working with hazardous material should avoid contact with them in order to minimize the risk of birth defects.

**Conclusion**

Prevention and risk assessment of teratogens is essential for the normal development of the fetus. The exposure to variety environmental factors such as chemical, physical, viral/bacterial diseases can lead to many congenital malformations or birth defects.

Very recently, FDA provided key messages for the management of teratogens in order to mitigate teratogenicity risk. The risk management strategies are divided into two groups.

Label + Med Guide - includes boxed warning, contraindication, warning and precaution and pregnancy category.

REMS - includes pharmacy certification, health care setting limits, and patient access to drugs, patient monitoring and patient registry.

Endpoint measure, measures of risk and compliance assessment could potentially provide determination of effectiveness and management of exposure to teratogens and to limit the adverse effects19.

**References**

[1]. Antepartal Care: Teratology; figure, retrieved from https://sarahays.wordpress.com/2008/02/12/antepartal-care-teratology/
[14]. John Freeman, BSc (Hons), LLB (Hons), Corp. Vice “Global drug Safety and Risk management; fda.gov.
An Overview of Ebola Viral Disease

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Epidemiology/Introduction

Ebola virus (EBOV) and Marburg virus (MARV). Members of the Filoviridae virus family, are known as emerging and re-emerging zoonotic pathogens causing acute hemorrhagic fever with high case-fatality rate in human (up to 90%) (1).

Ebola hemorrhagic fever (EHF) was first reported in 1976 during the Ebola outbreak in the Democratic Republic of the Congo (formally Zaire), and the virus is named after the Ebola River where it was discovered. Since then, 21 additional Ebola virus disease (EVD) outbreaks among human have occurred in the tropical regions of sub-Saharan Africa. The largest one to date took place in the Gulu District of Uganda in 2000-2001 caused by Sudan virus (SUDV). This outbreak resulted in 425 cases, of which 216 were laboratory confirmed, and the overall case fatality rate was 53% (20). The Ebola strain that is now circulating in West Africa bears shows the homology of 97% with Zaire Ebola virus samples found in the Democratic Republic of Congo and Gabon(2). Historically, this strain has caused the highest mortality (90%), while the current estimate of case fatality rate is less than 60% (3).

During December 2013, the epidemic of EVD started in Guinea(2), and the World Health Organization (WHO) received official notification of a rapidly evolving outbreak of EVD on March 23, 2014, in August 2014, WHO declared this to be a “public Health Emergency of international concern”(3). In mid-September 2014, the case fatality rate among patients with definitive outcomes was 70.8% (95% confidence interval (CI), 68.6 to 72.8) and was consistent among Guinea, Liberia, and Sierra Leone. Nigeria’s case fatality rate was lower at 45.5%, although the current estimate is based on only 11 recent cases. The in-hospital case fatality rate was 64.3% (95% CI, 61.5 to 67.0), which was lower than those for all patients with definitive outcomes, and this rate was consistent among countries. A range of 56.1% (95% CI, 41.0 to 70.1) in Guinea to 80.0% (95% CI, 68.7 to 87.9) in Liberia of health care workers died. Despite multinational and multisectoral responses to the disease, a growing number of new cases and death were reported every week (4).

There is no change in the control in the measures for this epidemic and by November 2, 2014, the cumulative reported numbers of Ebola confirmed and suspected cases for Guinea, Liberia, and Sierra Leone are predicted to be 5740, 9890, and 5000, respectively, exceeding 20000 cases in total(4). The majority of cases are between 15 to 44 years old (49.9% male). In terms of reported morbidity and mortality, the current EVD epidemic is much greater than all previous outbreaks combined. The real number of those who have been infected and died is likely much higher (4).

This time, the outbreak has become so large that the three most affected countries, namely, Guinea, Liberia, and Sierra Leone, face numerous challenges for the implementation of rigorous control measures at the scale needed to prevent transmission and to supply all EVD patients with clinical care(4).

Species of ebola virus

The genus Ebola virus is classified into five different virus: SUDV, Tai Forest virus, Reston virus, EBOV, and Bundibugyo virus. Among them, EBOV causing the EHF is associated with the highest fatality rate in humans (57%-90%), followed by SUDV (41%-65%) and Bundibugyo virus (40%). To date, Tai Forest virus has only been known to cause two nonfatal human infections, while Reston virus cause asymptomatic infection in humans.
The viral hemorrhagic fever (VHFS) represent a group of diverse animal and human diseases caused by RNA virus belonging to four distinct families including Arenaviridae, Filoviridae, Bunyaviridae and Flaviviridae. The severity and clinical symptoms of VHFs may significantly change depending on different factors: the type of causative agent, and the epidemiological and clinical features of host.

In general, all patients shows evidences of fever and coagulation abnormalities that may lead to disseminated intravascular coagulation, multiple organ failure, signs of shock and eventually death. The VHF can be severe and life-threatening, and it may occur as isolated cases, such as cases imported from endemic areas, or may cause a devastating lethal outbreak. Human sporadic and outbreak cases have been reported with high case-fatality rate, involving social and economic disruption

**Structures**

Filo viruses are enveloped particles with a non-segmented, single stranded, negative-sense RNA genome, approximately 19 kb in size. EBOV and MARV genomes encode seven structural proteins, and also EBOV encodes two nonstructural soluble glycoproteins (GP): soluble GP and small soluble GP. All known MARV strains consists of one Species Lake Victoria Marburg virus, while EBOV strains consist of four different species: Zaire Ebola virus (ZEBOV), Sudan Ebola virus (SEBOV), Cote d’Ivoire Ebola virus (CIEBOV) and Reason Ebola virus (REBOV). The newly discovered Bundibugyo Ebola virus (EEBOV) has been proposed as the fifth species. The species vary in their apparent pathogenicity in human; ZEBOV is the most pathogenic (up to 90% case fatality rate), followed by SEBOV (approximately 50% case fatality rate) and BEBOV cause lethal infections in nonhuman primates, but not being associated with fatal human cases yet(1,8). By systematic viral replication, EBOV and MARV result in the release of high levels of inflammatory cytokines, coagulation abnormalities and fluid distribution problems. These process are observed as hemorrhage and leakage; ultimately these may lead to multiple organ failure and shock (9, 10).

ZEBOV was first discovered in 1976, being the most virulent species with case fatality rates in humans up to 90% and as high as 100% lethality in experimental macaque models, the current gold standard animal model for ZEBOV among other established models (11).

**Reservoir**

Recent evidence has confirmed the importance of bats as potential reservoir species of filo viruses; however, it is unclear whether other species are also involved or how transmission to human and/or apes takes place. EHF is believed to persist in a reservoir species generally found in endemic places. Apes, man, and perhaps other mammalian species being susceptible to Ebola virus infection are considered as end hosts of Ebola rather than as reservoir.

Although wide efforts have been made to find the natural reservoirs in large outbreaks of EHF, neither potential hosts nor arthropod vectors have been identified. For a long time, rodents and bats have been regarded as potential reservoir species. This was proved by experimental studies in African plants and animals that confirmed the transmission of productive infection of African fruit and insectivorous bats with ZEBOV, though a firm link could not be achieved. The inspection for potentially vectors, especially among arthropods has been always negative, including bedbugs (cimex hemipterus) captured in the beds of infected persons.

**Transmission**

Presumably, most index cases become infected through contact with an infected animal. While planning defenses against bio warfare agents such as filo viruses, it is important to consider that respiratory portal of entry is the most likely route of dissemination of agents such as aerosols.

The virus is transmitted to people as a result of direct contact with body fluids containing virus (vomitus, sweat, stool, urine, tears, breast milk, saliva and respiratory secretions) of an infected patient during the acute stage of disease.
Epidemiological studies have revealed that family members are at risk of infection because they may come in contact with infected body fluids or may help to prepare the corpse of an infected person for burial. Direct contact with virus containing material from contaminated hands of caregivers to their own mouth or eyes is the most common cause. Caregivers who work both at home and in the hospitals are at greatest risk for exposure.

While studies have proved the spread of EBOV and MARV via aerosol particles under controlled laboratory conditions such transmission rarely appeared in humans in a hospital or household setting during epidemics.

Further, infection can occur through sexual contact and the virus has been traced in semen for up to seven weeks after recovery. It is recommended to control and use condoms during intercourse, and to avoid breast feeding for at least three months after recovery to prevent secondary cases. The center for Disease Control and Prevention (CDC) has clearly outlined isolation procedures (3).

The spread of infections are also the product of nosocomial or occupational transmission. For instance, in the first epidemics of Ebola, Zaire, in 1976, the usage of contaminated needles resulted in simultaneous outbreak among over hundreds patients. Another example covers spread of the virus to an entire surgical team who performed an exploratory laparotomy on an infected patient in Kikwit in 1995.

In fact health care workers coming in contact with affected people were mostly consisted as the first generation causes in previous outbreaks. The propagation of infectious diseases can be avoided among health care workers through early detections of subjects and enforcement of appropriate preventive practices. Historically, outbreaks have gradually burned themselves out or have been controlled by effective public health measures including isolation of sick individuals and appropriate barrier protection methods for care providers and funeral services. It is believed that transmission of viruses needs direct contact or contact with infectious fluids rather than a possible aerosol route of transmission.

EBOV and MARV are regarded as re-emerging and highly infectious pathogens. Outbreaks have been associated with human sporadic cases, involve high rates of cases-fatality and cause social and economic disruption. The substantial appearance of both EBOV and MARV with severe hemorrhaging in most cases has also contributed to the high transmission rate and the fear of epidemic and imported cases. According to the US CDC, EBOV and MARV have been classified as category a bioterrorism agents due to their highly infectious nature and potential use in biological weapon.

Clinical aspects

Before the recent epidemic in West Africa, past EVD outbreaks in central Africa had been limited in size and geographic spread, typically affecting one to a few hundred persons, often residing in remote forested areas.

Recognizing the signs of EVD is challenging, the incubation period usually last 5 to 7 day although it can be as short as 2 days and as long as 21 days. Approximately 95% of the patients appear signs within 21 days after exposure which is the recommended period for follow-up contacts. In general, blood samples start to be tested positive by polymerase chain reaction-based diagnostics one day before symptoms onset.

Typical features include fever, profound weakness, diarrhea, abdominal pain, cramping, nausea and vomiting for 3-5 days and may be persisting for up to a week. Some patients may also have pharyngitis and maculopapular rash. Laboratory complications including elevated aminotransferase levels, marked lymphocytopenia, and thrombocytopenia may have occurred.

Clinical EHF is featured by sudden onset of fever, fatigue, chills, general malaise, headaches, myalgia, anorexia and gastrointestinal distress within 3-13 days following exposure to virus. Many patients develop hemorrhagic manifestations from which the term “hemorrhagic fever” has been derived.

Hemorrhagic fever occurs in less than half of infested subjects and gross bleeding is relatively rarer. The most common signs reported between symptom appearance and case detection include fever (87.1%), fatigue (76.4%), loss of appetite (64.5%), vomiting (67.6%), diarrhea (65.6%), headache (53.4%) and
DOI: 10.21522/TIJMD.2013.05.02.Art002
ISSN: 2520-3118

abdominal pain (44.3%). Certain hemorrhagic features were rarely reported (in <1% to 5.7% of patients); however, unexplained bleeding was reported in 18.0% of cases.

These patterns are the same for all countries. Bleeding takes place most commonly in the gastrointestinal tract and may demonstrate as melena, petechial, conjunctival hemorrhage, hematuria, easy bruising, or intraperitoneal bleeding. Mucous membrane bleeding, failure venipuncture sites and excessive clot formation have also been described.

These symptoms progress over the time and patients suffer from dehydration, stupor, confusion, hypotension and multi-organ failure, leading to fulminant shock and eventually death. Fatal causes tend to develop early clinical signs during the infection and death often occurs between the sixth and sixteenth days of illness.

**Pathogenesis and laboratory abnormalities**

At the entry site into the body, MARV and EBOV are capable to infect macrophages and other cells of the phagocytic system. Macrophages in vitro are highly susceptible to infect and produce a large number of viral particles, and hence serve as a vehicle to deliver the virus to a variety of organ systems such as liver, endothelium, spleen, lymph nodes, kidney, adrenal gland, and pancreas.

Marked leucopenia with a left shift and atypical lymphocytes can be observed on peripheral smears of infected patients.

Since lymphocytes are not assumed to be host targets for the virus, a substantial reduction in the number of lymphocytes is supposed as a result of bystander apoptosis, showing the death of a large number of lymphocytes triggered by mediators which are released from virus infected target cells and/or secretion of viral GP. Impaired production of pro-inflammatory cytokines and impaired stimulation of T cells also play a role in this phenomenon.

EBOV seems to utilize multiple cellular pathways for entry into host cells. Potential key mechanism in neutralization cover direct inhabitation of GP attachment to cell surface or endosomal receptors and blocking fusion of the viral and host membranes. Preventing cathepsin-induced cleavage is another formal possibility, albeit controversial.

Through experimental infection of nonhuman primates (the gold standard animal model for Ebola virus infection), laboratory studies have known many aspects of the disease, because the signs and disease induced in these animals are similar to those appeared in humans.

Filo viruses lead to highly cytopathic effect and are capable of rapidly replicating to high viral doses in a range of cells and cause their lyses. Filo viruses enter via small skin lesions and mucus membranes from which a direct access to the vascular system is available. There, monocytes, macrophages and dendritic cells are infected in the early stage of the disease; and due to rapid spread of the virus through the organs, particularly in the spleen, liver, and lymph nodes, the spectrum of target cells increases to include endothelial cells fibroblasts, hepatocytes and many other cells. Consequently, critically ill patients display intensive viremia and antigenemia.

Extensive information on EHF pathophysiology have been obtained from the samples collected during the Gulu outbreak including the observation of aspartate aminotransferase, D-dimer, blood urea nitrogen and higher creatinine levels than normal, although calcium and albumin levels are less than normal in samples from fatal EHF cases. Fatal rates were also affected by elevated levels of the cytokines interleukin 6, interleukin 10 and macrophage inflammatory protein, further human leukocyte antigen B67 (HLA-B67), HLA-B15 and marked CD8 lymphopenia contributed to fatal outcomes, while HLA-B7 and HLA-B14 were associated with neonatal outcomes in humans.

**Molecular assays**

Ebola laboratory diagnosis can be achieved in two different ways: measuring the host-specific immune responses to infection and detection of viral particles, or particle components in infected individuals.
Nowadays, RT-PCR and antigen detection ELISA are the main diagnostic assays for acute infections. Viral antigen and nucleic acid can be traced in blood from Day 3 up to Day 7-16 following systems begin.

The most general assays used for antibodies detection are direct IgG and IgM ELISAs and IgM capture ELISA. IgM antibodies can appear as early as two days following the onset of signs and disappear between 30 and 168 day after infection. IgG-specific antibodies develop between 6 and 18 days after illness onset and persist for a long time. An IgM or rising IgG titer (four-fold) contributes to strong presumptive diagnosis.

Considering the physiological kinetics of humoral response and since VHF resulted in impaired antigen-presenting cell functions, antibody titers are low at least in the earlier stages of illness. Therefore, serology is often not the major diagnostic option in critical phase, but it can be a particular useful practice to confirm the diseases etiology in convalescent patients.

**Diagnosis**

For diagnosis, the best option is to have a comprehensive, relatively unspecific definition in accordance with both clinical (fever and other symptoms) and epidemiological (contact with a case) criteria. Due to poor specificity of the symptoms, it is difficult to practice clinical diagnosis at the beginning of the epidemics.

After identification of virus responsible for the outbreak, all suspected cases should be considered at high risk of exposure and the case definition and exposure risks must be included for better management of the epidemic.

Case definition of EVD includes index case: very first case (probable or confirmed) reported as the origin of the epidemic; alert case: person with sudden appearance of high fever or sudden death or bleeding diarrhea, or bleeding in urine; suspect case: person, dead or alive, who has (or had): (a) fever (>38.50°C or 101.5 0F) with additional signs (severe headache, muscle pain, vomiting, diarrhea, abdominal pain, or unexplained hemorrhage) and (b) epidemiologic risk factors within the past 21 days before the start of symptoms (close contact with body fluids of a suspect or probable case of EVD, or direct handling of bush animals from disease-endemic areas; probable case: any person evaluated by a clinician, having symptoms compatible with EVD, or a dead person with an epidemiological link to a confirmed case contact person without suggestive symptoms of disease, but had unprotected contact with suspect or probable cases of EVD (living in the same house, providing care during the illness and participated in the burial rites). To assess the risk level is very important; confirmed case: cases who had positive laboratory response on the detection of either Ebola virus antigen or Ebola IgG antibody; not a case: person with specific detectable antibody or antigen for Ebola.

**Treatment and prevention**

A wide range of studies in vitro and several animal models have been developed for EBOV and MARV; however, currently neither a licensed vaccine nor an approved treatment is available. Scientists working in high containment facilities, health care workers in Africa and people residing in the affected areas in Africa run a risk of potential exposures. In the occurrence of bioterrorism acts involving filo viruses, the high-risk population could be quite extensive. Thus, as an important part of contingency plans, counter measures are developed.

Passive transfer of serum collected from survivors of Junin virus or Lassa virus has confirmed affected provided therapies which are begun quickly following the infection. However, the experiment of antibody passive transfer has highly failed to treat filo virus infectious. During a 1995 outbreak of EBOV in Kikwit, Democratic Republic of the Congo, seven of eight patients with symptoms and detectable EBOV antigen in their blood who received whole blood from convalescent EBOV patients survived.

The lethality rate (12.5%) from this treatment was significantly lower than the overall case fatality rate (80%) for the EBOV epidemic; however, it is often difficult to interpret the role of antibodies in the
achieved protection since the patients received whole blood, not just antibodies, from recovering patients in the additional hospital care. After the 1995 epidemic,

WHO product a commercially available equine IgG product from horses hyper vaccinated with EBOV for potential use in human. Similar IgG preparations had been used with reported success for hamadryas baboons, in which this antibody protected against lethal EBOV challenge. In contrast, the commercially available equine IgG did not fully protect cynomolgus macaques against EBOV, although clinical feature onset, viremia levels and time to death were delayed relative to the controls.

Recently, a great attention has been paid unlicensed treatments and vaccines. A “cocktail” of humanized-mouse antibodies (ZMapp) is among the therapies in development, showing promise in nonhuman primates. Two US citizens who recently evacuated from Liberia to Atlanta were given ZMapp and both patients demonstrated clinical improvements. Other candidate therapeutics covers RANA-polymerase inhibitors and small interfering RNA Nano particles that are inhibitors of production.

The results obtained from gene-silencing treatment using small interfering RNAs have been good both in guinea pigs and non-human primate models of Ebola infections. This data suggests that RNA interference may be an effective post-exposure treatment strategy for people infected with Ebola virus and perhaps other VHF agents. Unfortunately, production and cost issues can substantially constraint the current use of this approach.

Preclinical evaluated is also underway for various vaccine candidates. One is a chimpanzee adenovirus vector vaccine, into which two Ebola gene encoding glycoproteins have been inserted. Two other vaccine candidates involve vesicular stomatitis virus pseudo types. Human clinical traits for one of these vaccine is planned to start in early 2015.

In the past decade, many efforts have been made in the development of different vaccine platform and treatment strategies against filo virus. Though there is a lack of highly efficacious treatment options, multiple vaccine platforms have been developed with good efficacy against EBOV and MARV including virus-like particles, Venezuelan equine encephalitis virus replicons, replication incompetent adenovirus serotype 5 vectors, replication competent recombinant human Para influenza virus 3 and recombinant vesicular stomatitis virus (rVSV), all these platform have been assessed in the nonhuman primate models and proved to be protective.

Currently, the rVSV platform is one of the more promising vaccine approaches against filo virus. As a none segment, negative stranded RNA virus in the family Rhadovirus, VSV is primarily an animal pathogen, and no evidence is available for its role for acute illness in humans. Two serotypes, designated as serotypes New Jersey and Indiana, are known to be circulating on the American continent. Both are transmitted via mosquitoes, sand flies or black flies and cause a deadly effect. Two rVSV vaccine vectors have been extensively investigated over filo virus animal disease models: rVSV/ZEROV. GP expressing the GP derived from ZEROV strain Mayinga and rVSV/MARV-GP expressing the GP derived from MARV strain Muosotk.

The efficacy of rVSV/ZEROV-GP in vaccine or post-exposure treatments has been tested through mouse-adapted ZEROV in mice and hamsters, guinea pig-adapted ZEBV, SEBOV, CIEBOV and BEBOV in nonhuman primates. The researcher showed protective efficacy data of rVSV/MARV-GP against MARV infection. The protection for post-exposure rVSV treatment is still an unknown mechanism. Acting as a vaccine vector to induce very strong immune responses, VSV can overcome filo virus-driven suppression of this response, thus inhibiting filo virus replication and infection spread. It has been revealed that rVSV infect the same target cells as filo virus and the viral interference leads to a block in EBOV and MARV replication. Again, the development of a humeral non neutralizing immune response contributed in survival, but this is unlikely to be protective mechanism due to its late development.

At least, six different vaccine systems are promising complete protection for nonhuman primates against MARV or EBOV infection among those prospective vaccines with efficacy in nonhuman primate models of filo virus hemorrhagic fever; two options, one based on a replication-defective adenovirus
serotype 5 and the other on rVSV, have shown complete protection to nonhuman primates when administered as a single injection.

There are no approved vaccines or antiviral therapeutics for MARV or EBOV currently available for human use. Although MARV or EBOV hemorrhagic fevers are rare diseases, vaccination could be an important preventive tool for several groups including risk groups during filo virus epidemics in affected regions in sub-Saharan Africa (medical personnel, patients care personnel, family members); national and international healthcare workers and outbreak response personnel; laboratory workers conducting research on filo viruses; military and other services personnel susceptible to filo virus used as bio weapons.

VSV is the prototypic member of the family Rhabdoviridae and a number of its certain characteristics are important for a vaccine vector, namely, replication in almost all known mammalian cell lines, growth to very high titers and a strong induction of innate and adaptive (humoral as well as cellular) immune responses.

Providing vaccine to people before traveling to endemic regions of the world could help prevent life-threatening diseases. An effective preventive vaccine has the potential to defend against regional epidemics and reduce the likelihood of global transmission of filo virus infections. Studies on rhesus macaques prove that treatment with recombinant inhibitor of factor VIIa/tissue factor and activated protein C contributed to significant increased survival after the experimental infection with ZEBOV.

Activated protein C, recombinant inhibitor of factor VIIa/tissue factor and modipafant might be considered in feature clinical experimental plans for severe dengue and/or Ebola infections in patients which are known to proceed through shock and not responsive to standard support treatments. Finally, it was found that transgenic mice expressing very high levels of human mannose binding lectin concentrations (a C-type lectin that recognizes hoxose sugar and acts as a first-line host defense against a wide range of viral pathogens) are more resistant to fatal Ebola infections than wild-type mice. This suggests that modulation of mannose binding lectin activity may be an interesting field for further clinical studies.

Ebola patients receive supportive care; no licensed therapy is known to be effective against the virus. Basic clinical supports consist of aggressive volume and electrolyte management, oral and intravenous nutritional therapy and medical interventions to control fever and gastrointestinal distress as well as to treat pains, anxiety and agitation. Diagnosis and treatment of concomitant infections and super infections including malaria and typhoid are also regarded as important aspects of patient care.

In the recent past, experimental post-exposure interventions against filo virus infections have consisted of hyper immune equine IgG, EBOV-specific human monoclonal IgG antibody, whole blood transfusions from convalescent survivors, recombinant interferon, recombinant nematode anticoagulant protein C2, recombinant human activated protein C, rVSV vectors, small interfering RNANs and phosphorodiamidate morpholino oligomers.

These interventions can reduce the likelihood of early infections in humans; improve biological safety; provide infection-control training and equipment for hospitals and ambulance; decrease the number of epidemics; provide leadership for behavioral change involving safe burial practices and equipments; communicate with community members and health workers; reduce the spillover of zoonotic diseases into human populations; prevent contact between humans and bats; improve food security; and minimize dangerous handling of consuming bush meat. Three core treatments have contained all previous Ebola viruses and can stop this one as well: exhaustive case and contact finding, effective response to patients and the community and preventive interventions.

Laboratory experiment with RT-PCR provides sensitivity and specific and can return the results within some hours; the test is now becoming more popular and widely available in the affected areas. Responding to cases includes the treatment of patients while isolated, through contact tracing and monitoring all contact up to 21 days after exposure. It is difficult to isolate and treat people with EVD, not
because the illness is particularly infectious or it is particularly hardy virus, but a single lapse can have devastating consequences.

Neither negative air flow nor special respirators are needed; it requires meticulous and scrupulous attention to guidance on gown, gloves, facemask and eye protection and great caution while removing protective equipments. Improvement in hospital infection control measures through the region would have a significant impact on the number of EVD and other diseases. Soap and water or alcohol-based hand sanitzers can disrupt the envelop of this single-stranded RNA virus, and dilute bleach effectively protects against contamination and are readily available even in remote settings.

Provision of supportive therapy especially fluid and electrolyte maintenance and treatment of bacterial super-infections can substantially improve survival rate, initiating identification of contacts and measure of people’s temperature daily for 21 days following exposure are needed. There are three main preventions, and the first is to practice strict infection control measures in health care settings; the highest risk of transmission occurs among patients with delayed detection and isolation, not those with diagnosed infection. The second is to provide education and support for the community regarding modification of long-standing burial traditions aimed for preventing direct contact with the blood and body fluids of infectious people, at least temporarily, until the outbreak is controlled; and it will stop the second key medium of the virus widespread. This issue is culturally sensitive that requires culturally relevant and appropriate outreach and educational materials. The third is to avoid direct contacts with bush meat (wild animals hunted for sustenance) and bats (that may be primary natural host of Ebola virus) can eliminate the risk of early importation of Ebola virus into humans.

Health-care workers’ knowledge and practices regarding the safe infection-control measures including an appropriate use of personal protective equipment offer protection to both workers and patients, because health care associated infection has been a major cause of transmission during previous outbreaks.

Suspected patients should be isolated immediately from other patients and barrier practices should be instituted. In addition, strict precaution should be taken when dealing with specimens to avoid propagation of the infection among caregivers. Precaution tools need to be consistently used, like gloves, gown, face shields, mask and eyewear. Further, the existing CDC guidelines recommend respiratory protection by using N-95 respirator. Cleaning and decontaminating surfaces and objects contacting with patients must be considered in order to prevent the transmission to health workers and family members.

**Conclusion**

EVD is a painful reminder that an outbreak anywhere can be a risk everywhere. The Global Health Security Agenda seeks to enforce public health systems in most affected countries in order to eliminate the spreads before they become emergencies. Although great improvement have been achieved over the past decade, better surveillance, real-time sharing of data and taking rapid action based on the available information remain necessary. Because Ebola virus is primarily transmitted through contact with the body fluids of symptomatic patients, the infection spread can be stopped by an early diagnosis, contact tracing, patient’s isolation and care, infection control and safe burial.

**References**

[1]. Asian Pacific journal of Tropical Biomedicine.

[8]. Waheed Y. Ebolain West Africa: an internal medical emergency.


Multi-Morbidity and Lifestyle in Western Nigeria: A Qualitative Study

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Abstract

The relationship between multimorbidity and lifestyle has been well documented in literature. Most of what we know about this issue was based on quantitative studies. We believed this qualitative study might allow the exploration of the understanding, beliefs and experiences of the multimorbid persons on this relationship.

In a period of three months in 2016, three focus group discussions were conducted in the family practice clinics of a hospital in western Nigeria. The discussions lasted 60 – 75 minutes and involved 22 adults participants aged between 25 and 73 years. We made use of a discussion guide of open ended questions with relevant probes. Constant comparison method was used for data analysis.

This study showed that multimorbid persons perceived their illness as part of normal aging process, sometimes running in families and associated with lifelong treatment and premature death. These perceptions informed adaptive behavior in relation to lifestyle modification, optimism and self-care tendencies focused on creating a harmony between their identity and the illness experience.

We therefore recommend the adoption of the patient centered approach in the management of multimorbidity to improve quality of care. We advocate further studies on these issues to contribute to the development of evidence based management framework tailored to the realities of people with multimorbidity.

Keywords: Multimorbidity, lifestyle, Qualitative study, Focus group discussion, Constant comparison method.

Introduction

The emerging burden of multimorbidity on socioeconomic indicators and healthcare systems worldwide calls for concern [1, 2]. The literature in the past two decades reported multimorbidity as a significant problem in terms of high healthcare utilization, reduced quality of life, high cost of care and high burden of illness and treatment [3].

Multimorbidity occurs when there are at least two chronic conditions in the same person [3]. Multimorbidity is different from comorbidity. Comorbidity refers to a situation when an index disease coexist with other conditions. These conditions may not complications of the index disease [4, 5]. In multimorbidity, there is no index disease among these conditions.

Clinical management of multimorbidity constitutes a challenge to both health care providers and patients. Currently best practice guidelines utilized for the in the management of individual chronic diseases are not suitable for the management of multimorbidity [6]. The use of these guidelines in the context of multimorbidity is associated with high cost of care, complexity of care and conflict in clinical decision making.

Current medical knowledge offers no cure for multimorbidity but provides avenue for prevention of complications, enhances functional capabilities and improves quality of life. [7, 8, 9].

In the search for the aetiology of multimorbidity, reports of several studies show significant relationships between lifestyle factors and multimorbid chronic conditions [10, 11]. This relationship was established...
with physical inactivity, obesity, smoking, alcohol consumption, chronic stress and unhealthy nutrition [12 -15]. In the prevention of multimorbidity, it is important to consider the role of lifestyle factors [16].

This qualitative study formed a part of a mixed method study to examine the relationship between multimorbidity and lifestyle. We aimed to explore the understanding, beliefs and experiences of multimorbid participants and integrate this with the results obtained from analysis of quantitative data obtained from the same study population on the relationship between multimorbidity and lifestyle in our environment.

Materials and methods

We made use of the constant comparison analysis approach to analyze data transcribed from three focus group discussions (FGD) involving a total of twenty two eligible participants attending the family practice clinic of Federal Medical Centre, Abeokuta. The constant comparison analysis emanated from the grounded theory of qualitative methodology [17]. Grounded theory is a type of qualitative data analysis involving the identification of categories and concepts within research memos linked together to become theories. Constant comparison analysis produces explanations for human behaviours and experiences in their peculiar context [18].

Practically pieces of data was compared with all others. Similarities and differences are found out. Linkages between these data leads to the generation of common theories and categories. These theories and categories form the output of the analysed data from the qualitative enquiry.

Participant recruitment

The study took place from July to September 2016. Qualitatively data was obtained from three focus group discussions (FGD). A focus group discussion provides a structured premise for acquiring in depth information from a group of participants on a subject matter [19]. The aim of a focus group discussion is to gather information about people’s opinions, beliefs, attitudes, perceptions and experiences and not for consensus building or decision making [20].

All the twenty adults study participants provided written informed consent. They were recruited with the support of two trained research assistants. Doctors attending to patients in the clinics were requested to send patients with diagnosis of multimorbidity to the research assistants. Exclusion criteria included people with above moderate mental handicap, psychosis disorder and deafness. The research received ethical approval from the institutional ethical committee.

Eligible participants were divided into three groups based on agreement on the date chosen out of the three days designated for the focus group discussions. They were reminded by phone calls and text messages two days and a day before the scheduled dates. This communication was also used to confirm their availability for the FGD or voluntary withdrawal from the study.

The sampling method ensured that the groupings are heterogeneous enough to provide a diversity of knowledge, beliefs and experiences on multimorbidity. We ensured the three age groups (young, middle and old) were represented although not in equal proportions. Eight participants participated in the first and second discussions while six attended the third discussion.

Each of the FGDs was held at the departmental seminal room. We ensured no interruptions during the discussions which lasted between 60 to 75 minutes. Participants and the researchers were seated comfortably in a circular fashion. One research assistant took notes while the other one ensured adequate function of the battery operated voice recorder throughout the period. All the participants agreed to manual recording and audiotaping of the discussions. The research team was properly introduced to the participants. Ground rules were discussed and agreed upon by all present. These include confidentiality (the content of the discussions would only be known by those present), one person speaking at a time (to enable the identification of the speaker for the purpose of transcription and analysis) and the maximum time of 90 minutes available for the discussions. A prepared discussion schedule guided the commencement and exploratory nature of the proceedings. Open ended questions and probes were used as appropriate to generate responses from the participants.
We made use of focus group discussion schedule as follows.

Theme 1. Understanding of multimorbidity
- Can you explain your understanding of the occurrence of multiple chronic diseases in one person?
- Can you explain what you associate with this health problem?

Theme 2. Multimorbidity experience
- From your experience what importance do you attach to these several chronic diseases affecting you in particular?
- What is your experience living with several chronic diseases? Probing done for illness experience, medications, opinion on care givers and personal relationships as appropriate.

Theme 3. Link between lifestyle and multimorbidity
- What do you understand by the link between this health problem and your lifestyle? Probing done for specific lifestyle factors – diet, heavy alcohol consumption, cigarette smoking, exercise, excess weight and stress.
- Describe your lifestyle before and after diagnosis of several chronic diseases.

Data analysis
Following each focus group meeting, the audiotapes were transcribed verbatim. These documents in addition to recorded memos of the meetings were read by the author. Twenty three themes were selected. These themes were discussed with the research assistants regularly during and after the three FGDs.

We applied the constant comparative method of data analysis. The tree steps of coding and categorizing were used: open coding, axial coding and selective coding. Open coding was used to label data theme by theme. Thereafter, the themes were combined into categories. We used axial coding to make connections between categories. Axial coding allowed for making connections between categories [21].

Finally, selective coding was done to produce core categories around which the other developed categories can be grouped. Selective coding is the process of selecting the core category, systematically relating it to the other categories, validating those relationships, and filling in categories that need further refinement and development. The core category is the central phenomenon around which all the other categories are integrated [9, 22].

After categorization, the major categories that emerged are presented in the next section.

Results
Sample description (Table 1)
The mean age of the participants was 49 years (range 25 - 73). Of the participants involved, 15 were females and 7 males. Majority of the participants were in middle age group (63.6%). Over 95% had secondary education and above. Most of the participants were married (72.7%). About seventy seven percent were living with a partner at the time of the study. The chronic diseases documented in this sample included hypertension, diabetes mellitus, musculoskeletal disorders, cardiovascular disorders, gastrointestinal disorders, bronchial asthma and mental health problems. They have been receiving medical care for these chronic diseases from between 6 months and 16 years.

Table 1. Characteristics of the 22 multimorbid patients who participated in the three focus group discussions

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>15</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
</tr>
<tr>
<td>25 – 45</td>
<td>5</td>
</tr>
<tr>
<td>46 – 65</td>
<td>14</td>
</tr>
<tr>
<td>&gt;65</td>
<td>3</td>
</tr>
<tr>
<td>Income</td>
<td></td>
</tr>
</tbody>
</table>
Participants understanding of multimorbidity

Multimorbidity as part of aging process.

The relationship between aging and occurrence of multimorbidity emanated from this interaction. Participants were of the opinion that developing multiple chronic diseases is part of the normal process of growing old. According to them ‘aging is a normal process involving necessarily body weakness and ill health’. They saw the multimorbidity experience as a normal living process if one must get old.

Genetic predisposition

A middle aged female participants said ‘my mother had hypertension, arthritis and obesity, I was not particularly surprised when I developed these conditions’. She believed that some of these conditions run in families as one of her siblings was also obese and hypertensive.

No cure belief

Although some of the participants initially looked towards a permanent cure for these conditions, they later found out that they had to live with these illnesses for life. The initial belief led some of them to make use of complementary and alternative medicines that offered no remedy. The experience of living with several chronic diseases for life in these participants was derived from effects of multiple treatment regimens, declining physical functioning, mental state, and changes in family dynamics and available of community resources to support their daily life. They believed their body and psyche was changed by this experience. They accepted these adjustments in lifestyle experience as necessary for coping with the emerging state of health associated with growing old.

Treatment for life

While accepting the lifelong treatment required to maintain health, they all agreed that this process made them became more aware of how their body functions and some of the things to do or not to do to maintain good health. ‘I am a more disciplined man as far as my body and health is concerned, I no longer treat myself anyhow’ (middle aged man). They are aware they needed to take many medications that may have adverse effect on their body in addition to the therapeutic indications. They appreciated the fact that the various medications helped them to maintain or improve on their health conditions.

Multimorbidity as a cause of premature death

The participants appreciated the level of seriousness or severity of their chronic conditions. They have come to terms with the fact that with or without treatment, they are at risk of premature death. ‘As I go
along, the fear of death is appearing real’ (middle aged woman). The premature death may either result from the adverse effect of multiple treatments they receive or from the diseases destroying their body.

**Health care seeking behavior**

The participants appreciated the need to see their health care providers regularly. The downside to this was the challenge of consulting with various specialists for the many medical conditions they suffer from. A middle aged male explained as follows ‘I saw cardiologist for heart disease, dietitian for weight problem and orthopaedic surgeon for arthritis. All the three care givers recommended weight reduction but gave me conflicting and unclear and at times impractical guidelines. At the end other my weight problem remained’. From this experience, they suggested that it would be productive to limit the care to one doctor to coordinate.

Another aspect of the health seeking behavior is the effect of various health care suggestions from friends, neighbors and relatives. One young adult female participants said ‘my friend introduced me to Chinese herbal products with a claim of cure for diabetes mellitus. After a few weeks I had to stop because my blood sugar kept rising’. Having this problem made them prone or gullible to non-beneficial advice from people around them. The participants were at one time or the other exposed to the use of complementary and alternative medicine (CAM).

**Lifestyle and multimorbidty**

The burden of multimorbidity is complex. It was evident that the participants experienced both illness and treatment burden. These had profound effect on many aspects of day to day living. The participants presented the picture of a changed lifestyle involving physical, social and mental components. They have internalized the fact that their way of life would not be the same again. They also expressed the unpredictability of their state of health as they move on in life. One of them said ‘during a consultation with my doctor on some new laboratory tests, the new findings introduced some new medications I had to take and some new adjustments I had to make in my life from then on…living with these conditions can be alarmingly unpredictable’(middle aged female). This uncertainty and disruptions in lifestyle is not limited to medical decisions. It had to do with living as a whole; managing many medications, follow up visits, managing diets, following weight reduction exercises, avoiding stress and self-management.

**Weight problem**

The participants took personal responsibility for their weight problems. ‘As I was making progress in my career and growing up, I ate more and became less active. I felt I needed more as I was getting older. I heard of the need to do exercise but I thought that is for younger people. When these conditions developed I became aware of the benefits of exercise but then I need a lot of motivation to carry on ’ (elderly female). The participants were aware of the beneficial effect of weight loss. The main challenge to the participants was how to follow doctor’s recommendation on weight loss. ‘My doctor advised me to lose weight by reducing food intake and engaging in physical exercise, but I do not eat much. I did not know how to exercise. Jogging was suggested, but this is socially impractical in my environment’ (middle aged female). Another participants talked about the time and the motivation to carry out the exercise recommendation taking into consideration other various time demanding factors. They all felt the need for adequate motivation and self-discipline this demands.

**Nutrition changes**

The intake of unhealthy diet out of ignorance constituted a major part of the eating habit of the participants. ‘A number of fast food facilities are available around us. Out of convenience and also importantly because it was trendy to eat fast foods, we all engaged in this habit’ (middle aged female). They liken the practice of eating processed foods and snacks in eateries to a status symbol. ‘Everybody including children indulge in this practice. We were made to recognize the health risks involved when we were educated by our doctor’ (young adult male). To abide with diet recommendations provided by care
givers was challenging to the participants. According to a middle-aged man ‘there was some difficulty in arriving at a diet that goes along with my condition. After getting it worked out, I realized that changing to the new arrangement require substantial amount of discipline and motivation. I was not alone in this dilemma. My wife had to restructure her kitchen activities to meet the new demand. She made the matter manageable by sometimes taking these diets with me because of the health benefits’.

**Alcohol and cigarette smoking**

Some of the participants were occasional drinkers of alcohol. Only two of them smoked cigarette before. With the awareness of the deleterious effect of cigarette smoking and heavy alcohol consumption, these habits are at the time of the discussions things of the past.

**Chronic stress**

The participants are varied in their opinion as to what constitutes stress. One person reasoned stress out to be work-related. ‘*I think the stress of work I did for several years weakened my body*’ (elderly female). Another person related it to the economic challenges people face. It was also thought to be from marital disharmony and separation or divorce. A middle-aged female said ‘*I had problems with my spouse. We separated at the end of the day. This resulted in poor sleep for a long time and high blood pressure for me*’.

A young adult female said she had stopped attending social functions as this constituted stress for her in addition unhealthy diet she was exposed to at such social functions. It was clear from the discussions that patients need adequate education on stress and its relationship with multiple chronic conditions.

**Physical exercise**

The participants with hypertension and diabetes mellitus appreciated the importance of heeding the advice of the care givers on the need for regular physical exercise. They felt the illnesses and the old age makes they feel fragile and afraid to abide by this advice. They were afraid physical exercise might cause more damage to their body. ‘*I tried sometime to take short distance walks. The back and knee pains got worse that day*’ (middle-aged female). They opined that the social setting was not very conducive to exercises like jogging and running on the streets. These issues reduced the motivation to engage in physical exercise despite the awareness of the benefits.

**Self-care**

Most participants have become active in their health care over time. Important areas of self-care include attending medical follow-up, contacting the doctor on phone resolve pressing issues or unexpected developments, involving family members particularly the spouse in the care and support, managing unpleasant feelings and emotions about state of health relating physical impairment, trying as much as possible to take control of life and living related to various health challenges. The participants appreciated the advantages derivable from self-care. Exercise and healthy nutrition helps people with weight problems, hypertension and diabetes. ‘*When my weight reduced, my blood sugar was better controlled and also my blood pressure. I needed less number of medications*’ (middle-aged man). The participants also made of electronic sphygmomanometers and glucometers for home monitoring.

**Discussion**

In this study we explored patients understanding of multimorbidity, examined the illness experience of multimorbid persons and the lifestyle adjustments these participants had to make in response to the demands of their illness experience. The FGDs revealed the impression supported by a large number of findings that there is a strong link between multimorbidity and aging [23, 24].

A study by Fortin et al in 2012 found a higher prevalence of multimorbidity among people over 75 years when compared with the general population (3.5% - 98.5% versus 13.1% - 71.8%) [25]. Multimorbidity also occur in specific young or middle – age groups with endocrine disorders [26]. In some populations, more young than elderly people were found to have multimorbidity [27].
The knowledge of the familial predisposition to multimorbidity in the discussions reinforced scientific fact of the modification of genetic makeup by environmental and lifestyle factors [28, 29]. In cardiovascular disease, people of African ancestry have the tendency to have cerebrovascular complications while Caucasians tend to have coronary heart disease.

In their understanding of multimorbid chronic conditions, the participants appreciated the long-term and lifelong nature of their illness. Closely related to this is the seriousness or rather the severity of these conditions and the tendency to lead to premature death. As a cause of premature death, most studies agree that multimorbidity reduces life expectancy [30]. However there is evidence that the mortality is related to disability for multimorbidity rather than from multimorbidity itself [31].

From what the participants experienced with the clinical management of their conditions, they found it beneficial to be managed by one care giver to engender better quality of care. For instance a patient with hypertension and diabetes mellitus requires follow up by the cardiologist and the endocrinologist. This involves clinic visits for laboratory tests, prescriptions and counseling by each specialist. The quality of care associated with this multiplicity of care is related to the relief of illness and treatment burden experienced by the multimorbid patient. It is evident for the discussions that the participants needed a better approach to care. In addition, this current care model that emanates from single disease management paradigm has not taking into consideration psychosocial component of multimorbidity [32]. It becomes important therefore to consider psychological and social issues in the management of multimorbidity [33].

It is important to note that focusing only on physical aspect of multimorbidity in health care is associated with higher healthcare costs resulting from more frequent contact with healthcare system for each separate condition [34].

Use of complementary and alternative medicine (CAM) was common practice among the participants. Several studies show increased global trend in the use of CAM among patients with chronic diseases [35, 36]. As far back as 2002, prevalence rates of use of CAM in developed world had risen to about 60% [37]. The high prevalence made attention to be focused on the use, safety profile and effectiveness of CAM among patients and clinicians. Generally speaking, people perceive the use of CAM as a means of health maintenance and promotion [38, 39], symptom relieve in chronic/terminal illnesses and relief from the side effects of conventional treatments for chronic and terminal diseases [40, 41]. It has not yet been ascertained if these products are veritable adjuncts to convention medicine.

### Lifestyle and multimorbidity

Current practice offers to the multimorbid patient a fragmented medical care not at tandem with expectations and experiences associated with the illness [42]. The care of the patient is a series of specialty consultations that fails to resolve many physical and psychosocial challenges [43].

The goal of care for these patients has many dimensions. These are improving quality of life, managing polypharmacy, reduction in number of consultations, enhancement of self-care capability, increasing life expectancy, disability management and improvement in mental health [44]. It is difficult to achieve these goals. The proposal of an acceptable standard of care taking into consideration a constellation of biopsychosocial issues in multimorbidity remains a challenge [44].

In the light of the above therefore, attention has been given to the enhancement of self-care capability through lifestyle modification. The importance of lifestyle factors in the health prevention and promotion for the multimorbid patient had been the subject of several studies [45, 46, 47].

The participants appreciated the need for weight reduction for the overweight and obese patient. A study in the United Kingdom in 2014 found out that 32% of multimorbidity was attributable to overweight and obesity [48]. Although recommendations abound in literature on how to reduce weight, it remains a challenge for most patients how to put theory into practice.

As with weight reduction, the participants were aware of the beneficial effect of dietary adjustments on their health. Evidences supporting the relationship between greater intake of fruits and vegetables are conflicting. Ruel at al [2013] reported that greater consumption of fruits and vegetables appear to lower the
risk of multimorbidity [49]. This report is at variance with the findings of Fortin et al (2014) that not eating a recommended amount of fruit and vegetables was not associated with a higher likelihood of multimorbidity [50].

All the participants were neither smoking cigarette nor consuming alcohol at the time of this study. They were aware of the deleterious effect of these habits on their health. Cigarette smokers have a higher risk of developing several severe chronic physical and metabolic disorders like lung cancer, chronic bronchitis, COPD, stroke, hypertension, decrease HDL cholesterol and arteriosclerosis [51].

Although mild to moderate alcohol consumption has positive health benefits [52], heavy alcohol consumption have deleterious effect on the human body. There is increased risk of multiple organ damage resulting in multimorbidity and death.

The phenomenon of stress is poorly understood by many of the participants. According to Baun 1990 [53], Stress is an emotional experience accompanied by predictable biochemical, physiological and behavioral changes. Chronic stress is associated with mental, cardiovascular, musculoskeletal and neoplastic diseases [54].

While the participants were conscious of the fact that physical exercise promotes well-being as evidenced in literature [55], the social setting most of them live makes this practically challenging. According to them, they need substantial drive and motivation to engage in physical exercise. Health workers consoling multimorbid persons on physical exercise need to go beyond the theoretical prescriptions. Patients centered approach taking into consideration individual patient’s physical fitness, home and community peculiarities would yield desired results.

The participants developed over time the attitude of taking responsibility for their health. Their health seeking behavior was initially directed at what was obtainable for their care givers. The realization of lifelong nature of their illness led to social, behavioral, physical and attitudinal adjustments required for taking ownership of their diseases. [12, 33, 56, 57]. The benefit derivable from this paradigm include giving meaning to the multimorbidity experience and using this as an opportunity to make significant change in one’s lifestyle and one’s relationship with others. Furthermore, there emerges an establishment of harmony between the multimorbid person’s identity and the identity associated with the disease leading to an optimistic view of their situation [58] as manifested in the participants.

Conclusions

This study showed that multimorbid persons perceived their illness as part of normal aging process, may run in families, require lifelong treatment and associated with risk of premature death. These perceptions informed adaptive behavior in relation to lifestyle modification, optimism and self-care tendencies focused on creating a harmony between their identity and the illness experience.

The findings of this study should inform a shift in paradigm in policy and guidelines relating to the care of multimorbid persons. We recommend the adoption of the patient centered approach in the management of multimorbidity. Enquiry about the patient’s illness experience and coping mechanism and utilizing these in the design of individual patient management processes will positively impact on the quality of care for the multimorbid persons. We advocate further studies on this premise to engender the development of evidence based management framework tailored to the realities of people with multimorbidity.

Acknowledgements

I give special thanks to Akintunde Abioye – Kuteyi for providing the guidance right from protocol development, through study conduct to the eventual write up of the article.

References


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